

Unit 15.5

Day 2

Graphing Rational Functions

Part 1

## Rational expression

$\frac{h}{g}$ , where  $h$  &  $g$  are polynomial and  $g \neq 0$ .

## Rational function

$$f(x) = \frac{h}{g}$$

## Finding the asymptotes of a rational functions

### Three types of asymptotes:

- 1) Vertical asymptote  $x = \#$
- 2) Horizontal asymptote  $y = \#$
- 3) Oblique asymptote linear eq.

1) vertical asymptotes-is (are) vertical line(s) that the graph will never cross.

Finding the vertical asymptotes: set the denominator equal to zero to find the values of  $x$  that make the function undefined.

Ex1:  $f(x) = \frac{x+1}{2x^2+5x-3}$

$$2x^2+5x-3 \neq 0$$

$$(2x-1)(x+3) = 0$$

$$\boxed{x = \frac{1}{2} \quad x = -3}$$

vert asympt.

Ex2:  $f(x) = \frac{3}{-x^3-5x^2-4x}$

$$-x^3-5x^2-4x \neq 0$$

$$x = 0, -1, -4$$

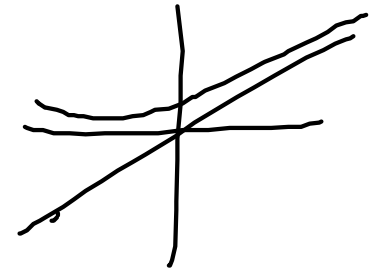
$$x = -1$$
$$x = -4$$

# FINDING HORIZONTAL ASYMPTOTES

- 1) If the  
degree of the numerator = degree of the denominator  
then  
the horiz. asymptote equals the ratio of the leading terms <sup>coeff.</sup>
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- 2) If the  
degree of the numerator < degree of the denominator  
then  
the horiz. asymptote  $y = 0$ .
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- 3) If the  
degree of the numerator > degree of the denominator  
then  
divide the num. by den. The dividend is the oblique  
asymptote (ignore remainder)



Finding horizontal asymptotes:

Ex1:  $f(x) = \frac{x+1}{2x^2+5x-3}$

$$y = 0$$

Ex2:  $f(x) = \frac{2x^2 - 3x + 1}{5x^2 + 6x + 1}$

$$y = \frac{2}{5}$$

## Finding an oblique asymptote:

Ex3:  $f(x) = \frac{x^2 + 7x + 6}{x}$

The image shows a handwritten long division process. On the left, the divisor  $x$  is written to the left of the dividend  $x^2 + 7x + 6$ . The first step shows  $-x^2$  being subtracted from  $x^2 + 7x + 6$ , with a horizontal line underneath. Below this, the result  $+7x + 6$  is written. Then,  $-7x$  is subtracted from  $+7x + 6$ , with another horizontal line underneath, leaving a remainder of  $6$ . To the right of the division, an arrow points from the circled quotient  $x + 7$  to the equation  $y = x + 7$ .

$$\begin{array}{r} x \overline{) x^2 + 7x + 6} \\ \underline{-x^2} \phantom{+ 6} \\ +7x + 6 \\ \underline{-7x} \\ 6 \end{array}$$

$y = x + 7$

## Homework

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